Localization of a Demand for Nursing Model at the Grassroots Level

Introduction

The attempt to forecast the demand for nurses at both the state and national level has been an ongoing process. A review of the literature which has been produced on the subject has not yielded any conclusive results, particularly at the state level, and no demand model for nursing has been produced which is not fatally flawed.

A major obstacle to the development of a usable demand model for nursing is the standardization of the definition for "demand". In microeconomics, demand refers to the amount of a good that consumers are both willing and able to purchase at a given price per unit of time. According to the "Law of Demand", the lower the price of a good, the larger the quantity consumers will want to purchase (Browning and Zupan, 2002). However, use of this concept becomes problematic when it is used in labor market analysis. Most states which have developed a demand model for nurses do not attempt to define the concept of "demand". There is a tendency, as the District of Columbia (DC) did in its 2001 prediction of the demand for nursing personnel, to utilize the term "demand" synonymously with "demand for labor". In the DC study, demand for labor was defined as the number of jobs either filled or vacant that exist for qualified people at a specific point in time. The lack of standardization of economic terms which are utilized in the state demand models is contributing to the failure of the long-range forecasting process for nursing nationwide.

Health Resources and Services Administration Model

Many states opt to utilize the data which the U.S. Department of Health and Human Services' Health Resources and Services Administration (HRSA) produced projecting state-level demand for full-time employed registered nurses (RN), licensed practical nurses (LPN), nurse aides, and home health aides through the year 2020. HRSA defined "nurse demand" as the number of full-time employed RNs whom employers are willing to hire given the needs of the population, economic considerations, as well as the healthcare operating environment (HRSA, 2006). Since this definition excludes LPNs completely, any state that chooses to utilize HRSA data has selected a model which is invalid due to failure to include all members of the nursing population.

HRSA also places great emphasis on the use of changing demographics as a key determinant of projected demand for full-time employees. It utilized the U.S. Census Bureau's projection of a rapid increase in the elderly population beginning around the year 2010 in formulating its equations (HRSA, 2006). However, the need for additional nurses to care for the increasing numbers of children in the public school system who have serious, chronic illnesses was never addressed.

The change in the racial and ethnic makeup of states such as Alabama was never mentioned. Because Alabama is a state which has experienced tremendous growth in its Hispanic population, the need for bilingual nurses in specific counties will be great. According to the Alabama Department of Public Health (ADPH), from 1990 to 2000, the number of Hispanics in the state rose 208% (Alabama Department of Public

Health, 2003). One county reported an increase of 2193% during this time period. The Hispanic population is younger than the non-Hispanic population, with 71.5% of Hispanics being under 35 years of age in Alabama as opposed to 48.4% of the non-Hispanic population being under 35 years of age. This means that some counties will see a greater need for pediatric nurses than others. Also, Alabama's Hispanic birth rate is more than twice than of the state's non-Hispanic population (33.3% per 1000), and in fact is higher than the national Hispanic birth rate of 22.9% per 1000. From 1990 to 2003, the number of Hispanic births in the state rose 759%. Almost half of all Hispanic mothers in Alabama in 2003 were between the ages of 10 and 24. In 2003, almost 11% of Hispanic mothers received no prenatal care at all, as compared to 0.5% for non-Hispanic white mothers and 1.4% for African-American mothers. Because the Hispanic population is much younger than the non-Hispanic population, the leading cause of death is accident as opposed to causes typically seen in an aging population such as kidney disease (ADPH, 2003). These statistics indicate that Alabama will need bilingual labor and delivery nurses who are prepared to care for very young mothers who have not had the benefit of prenatal care, in many instances, as well as bilingual trauma nurses.

A major flaw in HRSA's demand model for nursing is the derivation of the demand for nurses from the demand for healthcare services and failure to consider the price for nursing services. This inaccurately assumes that the elasticity of the demand for nurses will be identical to that of physicians. This is not appropriate, since many rural communities are served by one physician and multiple nurses, including home health nurses, nurse-run clinics, and physician's office nurses. Another inaccuracy which HRSA includes in deriving demand for healthcare services is that of failing to uniformly project demand for RNs over all twelve employment settings utilized in the model. Again, LPNs are not considered in the model development. Five of the employment settings used in the HRSA project demand for RNs using per-population ratios, while settings such as short-term hospitals utilize RNs per 1,000 inpatient days. Demand for nurse educators is projected using the assumption that they are a fixed proportion of the total RN demand in each state (HRSA, 2006). Given the separate shortage in nursing faculty in Alabama, this is a significant inaccuracy.

State Demand Models

Despite the inaccuracies and assumptions used in the HRSA model, some states have chosen to use it as a springboard for development of their own demand models for nursing. For example, the Center for California Health Workforce Studies developed a model of the supply of registered nurses in California and produced forecasts of demand which were based on data from the California Office of Statewide Health Planning and Development, the California Department of Finance, and a survey of Chief Nursing Officers (Spetz and Dyer, 2005). The authors of the document describing the forecasting procedure reported using estimates of the future demand for RNs from the U.S. Bureau of Health Professions and the U.S. Department of Labor. As with the HRSA model, the California demand model does not address demand for LPNs. All demand forecasts produced by the California model are in terms of full-time equivalent RNs, thus invalidating the model because of the large percentage of nurses excluded.

The authors also reported obtaining data on the RN population in California from the California Board of Registered Nursing. When actual numbers were not available, the authors obtained "best estimates" from the 2004 California Board of Registered Nursing Survey of RNs and the 1996 and 2000 National Sample Survey of Registered Nurses (Spetz and Dyer, 2005). Failure to consistently utilize actual numbers further invalidates this model, as does the use of databases which have not been generated by the authors. Use of such databases leads to difficulty in defending the data generated, since the authors will be unable to accurately prove the validity and reliability of data that they did not collect.

In comparison, the Pennsylvania Center for Health Careers issued documentation in 2005 detailing development of a model projecting the demand and supply of LPNs (Pennsylvania Center for Health Careers, 2005). This model used information collected from Pennsylvania's Workforce Investment Board, the Departments of Health, State and Labor and Industry, educators, and experts in the healthcare industry as well as policy makers. Demand was defined as the total of the number of LPNs employed in health care, employer vacancies, growth in the health care industry, as well as replacements due to nurses retiring or leaving the profession. Again, this model is flawed due to its use of data which were not collected by the researchers and therefore cannot be defended regarding reliability nor validity. The model also has the same limitations as the HRSA model and the California model-use of only one segment of the nursing population. No attempt was made to determine demand for RNs.

Another serious limitation of the Pennsylvania model is that it assumed that the number of nurses who are commuting into the state to work equals the number of nurses commuting out of the state to work. Also, unemployment of LPNs was assumed to be a constant figure with nurses moving in and out of the workforce; a further assumption was that it is unlikely that additional numbers of LPNs will be available to enter the workforce (Pennsylvania Center for Health Careers, 2005). Because of the multiple assumptions utilized by this model, a high estimate model of the supply and demand of LPNs was developed as well as a low estimate model. The high estimate model's replacement rate was derived from the number of years LPNs intend to remain in the profession, while the low estimate model's replacement rate used a career satisfaction factor to provide a minimum level shortage prediction. This model is invalid due to the multiple assumptions utilized as well as the high and low estimate versions which were developed.

As previously mentioned, the District of Columbia Consortium for Nursing for Nursing Education and Practice developed a forecasting model in 2000. A flaw of this model is apparent in the overview of the model presented in the final report from the Consortium. Although the model is intended to provide a long-term forecast of the number of nurses required from the year 2000 and beyond, the data provide a generalized "snapshot" of the dynamics of the current nurse workforce in the region of analysis (Hunt-McCool, 2001). This cross-sectional approach contradicts the longitudinal intent of the model. The District of Columbia oversimplified demand by defining it as the sum of vacancies and employment. The model stated that other things being equal, a large number of vacancies relative to filled jobs suggests increases in demand, increasing salaries, as well as increased pressure to hire workers of specific

skills. The model demonstrates a serious flaw by assuming that the various factors which are involved in producing the demand for labor can be equal at any particular point in time.

One advantage of this model is that it did include LPNs as well as Advanced Practice nurses in the nurse population. However, the model was able to make almost no forecast of the demand for Advanced Practice nurses. It stated that because employment of this group of nurses is low in comparison to other categories of nursing personnel, very little can be predicted about their positions (Hunt-McCool, 2001). The District of Columbia researchers initially attempted a formal statistical forecast using employment levels, salaries, work hours, and area specific health market factors, but concluded that this geographic area was too unique to respond well to national forecasting parameters. Therefore, a simplified model was created which defined supply as the number of employed nurses as well as the number of potential workers, and demand as the number of employed nurses as well as the number of vacant positions for nurses (Hunt-McCool, 2001). This reveals another flaw in the model, which is the use of the same population of workers to calculate both supply and demand. Because of the contradiction in the design of the model, which is cross-sectional when a longitudinal approach would be more appropriate, as well as the oversimplification of the concepts of supply and demand, this model is as seriously flawed as the previously discussed models.

In comparison, the nursing demand model developed by North Dakota's Center for Health Workforce, Center for Rural Health, and School of Medicine and Health Sciences of the University of North Dakota was precipitated by a facility survey, a survey of both RNs and LPNs, implementation of focus groups with both nurses and students, and a survey of nursing program faculty (University of North Dakota, 2003). A major flaw of the model was the presentation of data at multiple levels-county, state, and national-which may not be based on comparable data sets. Vacancy rate data and projections of both supply and demand were based on different surveys and databases. Current nursing demand was based primarily on vacancy rates derived from facility surveys, although the documentation noted that demand projections were also based on national and state factors along with historical trends, none of which were described in detail. This lack of information provided about all factors used to project demand is also a significant problem in this model. Furthermore, demand projections were also derived from the Job Service of North Dakota Employment Projections for 2000-2010, assuming annual growth of 84.5 RNs and 7.7 LPNs/year continuing at this same rate until the year 2013 (University of North Dakota, 2003). Again, use of data which were not collected by the researcher as well as assumptions which are not based on the researcher's own collected data can lead to serious questions regarding the validity and reliability of the model. It is highly unlikely that all of the factors, both economic and historical, which are used to project demand will remain at a level consistent enough to produce the same annual growth rate until the year 2013.

Some of the same flaws which were present in North Dakota's demand model were also noted in New Jersey's model. The New Jersey model utilized two different nurse employment databases to derive forecasts of nurse demand. The first database consisted of data for the total employment of RNs and LPNs in all health care environments, including hospitals, public health clinics, and long term care facilities, in

each New Jersey county for 1986, 1990, 1994, and 1996. Although these data were obtained from the New Jersey Department of Labor, they were originally derived from surveys and projections (Dickson, 2002). The second nursing database was developed from the American Hospital Association's survey of New Jersey hospitals. The AHA data provided information on the number of full-time positions for RNs and LPNs in each county, but only for the acute care sector (Dickson, 2002). These databases were inadequate to determine projections of RN and LPN employment.

The New Jersey model was an attempt to produce an econometric, longitudinal, multiple regression model to forecast demand for nurses at both the state and county level. Demand was defined as the number of nurses that employers would hire, given their availability. This model had the advantage of actually attempting to implement a test of its forecasting ability. Total RNs for 1998 and 2000 were calculated using the model, and a forecast of RNs was also calculated for the year 2010. The New Jersey model appears to underestimate full-time employed RNs when actually implemented. The number of RNs forecast for 1998 was underestimated by 5%, while the number forecast was underestimated by 9%. The 9% underestimate translates into approximately 7,000 employed RNs, a huge number for a lean labor market desperate for nurses. When a forecast of nurses for the 2010 was compared with comparable forecasts already made by the New Jersey Department of Labor, the Department of Labor estimated 12% more nurses in the workforce than the nursing demand model forecast (Dickson, 2002). This confirms a serious flaw in the New Jersey model, which consistently underestimates number of RNs. A summary of the advantages and disadvantages of each of the state nursing demand models which have been presented is illustrated in Appendix A.

Recommendations for Development of a Model for Demand for Nursing

Based on the Health Resources and Services Administration model as well as the individual state nursing demand models which have been developed, several recommendations emerge which would contribute to the evolution of a useable, realistic model of the demand for nursing which would provide a longitudinal picture suitable for forecasting. These recommendations are:
- standardize the definitions of "nursing demand" as well as "demand for nursing"
- include the effect of nurse compensation on demand for nursing
- include the price of nursing services since they cannot realistically be included in "health services"
- include both RNs and LPNs as part of the nursing population
- include changes in demographics in terms of pediatrics as well as geriatrics
- include changes in the racial and ethnic makeup of states
- use data actually generated by the researchers rather than by other sources
- use actual numbers rather than "best estimates"
- avoid using multiple assumptions regarding data
- use a longitudinal approach
- avoid presenting data at multiple levels and using incompatible data sets

Definition of Key Terms

Once a review of current demand models for nursing being used by various states has been completed, the task at hand becomes to determine if such a model can be developed for Alabama which would be viable enough to be utilized in other states. Econometrically, *demand* is the amount of good that consumers are both willing and able to purchase at a given price per unit of time (Browning and Zupan, 2002). In terms of demand for nurses, "amount of good" would be the expertise of a competent nurse, further specified as that of a registered nurse (RN) or licensed practical nurse (LPN) as well as the degree of specialization of skill required.

Demand also encompasses the amount of good that consumers are willing to purchase as well as the amount of the good that they are able to purchase. These are two separate concepts. The amount of nursing expertise that consumers are willing to purchase may greatly outstrip the amount of expertise that they can actually pay for. Also, the price at which consumers are willing to purchase nursing expertise may differ greatly from the price at which they can actually purchase that expertise.

Finally, the unit of time, defined as number of hours of nursing expertise, which consumers are willing and able to purchase at a specific price must be considered. This will vary depending on whether the demand is for an RN as opposed to an LPN, since one hour of RN time will cost more than one hour of LPN time due to the difference in salary. Also, if the demand is for a specialized type of nurse, such as an oncology-certified RN, the hour of specialized RN time will cost more than one hour of generalized RN time.

Factors Which Should not be Incorporated into a Demand Model

There are several factors which should not be incorporated into a demand model for nursing for Alabama. The District of Columbia defined demand for labor as the number of jobs either filled or vacant that exists for qualified people at a specific point in time (Hunt-McCool, 2001). Vacancy numbers are inappropriate to utilize in a nursing demand model since in a healthcare setting, the numbers of vacant nurse positions may in not equate with the realistic numbers of full-time and part-time nurse employees expected to be hired by nurse managers. Also, the Health Resources and Services Administration Model (2006) placed great demographic emphasis on the expected increase in the geriatric population. Any nursing demand model must consider not only the expected national increase in geriatrics, but also localized demographics. Some counties in Alabama have a much higher percentage of younger adults as well as pediatrics than other counties. Furthermore, in comparison to other states, Alabama's current life expectancy is only 74.4 years (Alabama Department of Public Health, 2006), thereby requiring a lower percentage of geriatric nurses than other states.

Localization of Nursing Demand Models

Such specificity reveals the need for localization of any nursing demand model at the county level to increase the degree of validity of the model. Certain counties in Alabama have a much higher percentage of Hispanics than other counties. As

previously mentioned, according to the Alabama Department of Public Health (2003), from 1999 to 2000, the number of Hispanics in the State rose 208%. This translates into the need to hire bilingual nurses in these counties who are experienced in pediatrics, trauma, and obstetrics. This equates to specific counties having an increased price for one hour of nursing expertise.

Factors to Be Included in a Demand Model

The outcome of in-depth analysis of the concept of demand for nursing as well as various demand models currently utilized by various states is the identification of a factors which must be included in a viable nursing demand model for Alabama. Ultimately, these factors could be used to design a demand model for every state. These factors include:

- **expertise of a competent nurse, specified as RN, LPN and degree of required specialization**-demand must incorporate the expertise of a *competent, licensed* nurse. The expertise of a nurse who has demonstrated incompetence through disciplinary action brought against the practitioner's license resulting from a public complaint would be of no value.
- **amount of nursing expertise consumers are willing to pay for**-the expertise of a highly specialized nurse will cost more than the expertise of a nurse generalist.
- **amount of nursing expertise consumers are able to pay for**-consumers at a higher socioeconomic level will typically be able to pay for a greater degree of nursing expertise than consumers at a lower socioeconomic level.
- **price at which consumers are willing to pay for nursing expertise**-this encompasses the public's perception of the worth of nursing expertise and its contribution to their health status.
- **price at which consumers are able to pay for nursing expertise**-for consumers at a lower socioeconomic level, this may not be comparable to the price at which they are willing to pay nursing expertise.
- **unit of time which consumers are willing and able to purchase at a specific price-**the price of this will vary depending on whether the expertise is for an RN or LPN and the degree of specialization.
- **demographics according to county**-counties where nurses are required to be bilingual and skilled in specialized areas will experience a higher cost of nursing expertise.
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Conclusion

It is anticipated that other factors significant in development of a nursing demand model will be revealed if the demand model shrinks to a county-by-county grassroots level. It is also anticipated that only at a localized level will the model be able to be translated into an equation which would actually calculate demand for nursing. A prototype model is presented in Figure 1.

Appendix A

Advantages and Disadvantages of State Nursing Demand Models

STATE OR DISTRICT	ADVANTAGES	DISADVANTAGES
District of Columbia	Included RNs, LPNs, and Advanced Practice nurses in the model	1. Failed to clarify terms related to demand for nursing 2. Use of a cross-sectional approach 3. Use of multiple assumptions 4. Use of the same population of workers to calculate both supply and demand
California		1. Failed to address demand for LPNs 2. Use of "best estimates" 3. Use of databases not generated by the researchers
Pennsylvania		1. Use of databases not generated by the researchers 2. Failed to address demand for RNs 3. Use of multiple assumptions
North Dakota		1. Presentation of data at multiple levels-county, state, and national 2. Use of potentially incompatible data sets 3. Failed to describe the state and national factors and historical trends used as the basis for demand projections 4. Use of databases not generated by the researchers
New Jersey	1. Attempted to produce an econometric, longitudinal, multiple regression model 2. Attempted to implement a test of its forecasting ability	1. Use of databases not generated by the researchers 2. Information utilized on number of full-time positions for RNs and LPNs only in acute care sector 3. Forecasting model developed consistently underestimates number of RNs

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